

A Dynamical Model of Jupiter's 5-Micron Hot Spots

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The Galileo Probe entered the Jovian atmosphere at the southern edge of a 5-micron hot spot, one of typically 8-10 quasi-evenly-spaced longitudinal areas of anomalously high 5-micron IR emission that reside in a narrow latitude band centered on +6.5 degrees. These hot spots are characterized primarily by a low abundance of the cloud particles that dominate the 5-micron opacity at other locations on the planet, and by significant dessication of water and hydrogen sulfide in the upper layers of the troposphere. Ortiz et al. (1998) found that the latitude and drift rate of the hot spots could be explained if they are formed by an equatorially trapped Rossby wave of meridional degree 1 moving with a phase speed between 99 and 103 m/s relative to System III. Here we model additional properties of the hot spots in terms of the amplitude saturation of such a wave propagating in the weakly stratified deep troposphere. We identify the hot spots with those locations where the wave plus mean thermal stratification becomes marginally stable. In these locations, virtual potential temperature isotherms stretch downward to very deep levels in the troposphere. Since fluid parcels follow these isotherms under adiabatic flow conditions, the parcels dive downward when they enter the portion of the wave associated with the hot spot and soar upward upon leaving the spot. We show that this model can account for many of the observed features of the hot spots, including (i) their vertical alignment over great depth, which persists despite the presence of strong vertical shear in the zonal wind, (ii) the anomalous vertical profiles of water and hydrogen sulfide mixing ratio measured by the Galileo Probe, and (iii) the absence of any thermal signature that can be identified from remote sensing of the hot spots.

Ortiz, J.L., G.S. Orton, A.J. Friedson, S.T. Stewart, and J. Spencer 1998. *J. Geophys. Res.* 103, 23051-23069.

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